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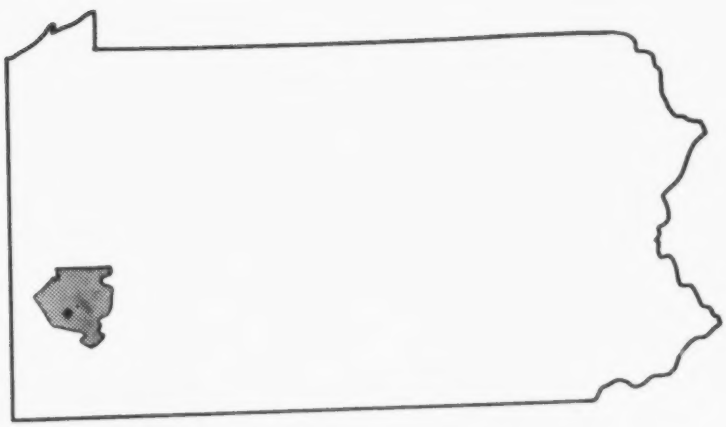
FLOOD INSURANCE STUDY

BOROUGH OF HEIDELBERG, PENNSYLVANIA
ALLEGHENY COUNTY



DECEMBER 15, 1980

federal emergency management agency
federal insurance administration

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TABLE OF CONTENTS

		Page
1.0	INTRODUCTION	1
	1.1 Purpose of Study	1
	1.2 Authority and Acknowledgements	1
	1.3 Coordination	1
2.0	AREA STUDIED	2
	2.1 Scope of Study	2
	2.2 Community Description	2
	2.3 Principal Flood Problems	6
	2.4 Flood Protection Measures	7
3.0	ENGINEERING METHODS	7
	3.1 Hydrologic Analyses	8
	3.2 Hydraulic Analyses	8
4.0	FLOOD PLAIN MANAGEMENT APPLICATIONS	9
	4.1 Flood Boundaries	10
	4.2 Floodways	10
5.0	INSURANCE APPLICATION	11
	5.1 Reach Determinations	11
	5.2 Flood Hazard Factors	13
	5.3 Flood Insurance Zones	15
	5.4 Flood Insurance Rate Map Description	15

TABLE OF CONTENTS - continued

	Page
6.0 OTHER STUDIES	16
7.0 LOCATION OF DATA	16
8.0 BIBLIOGRAPHY AND REFERENCES	16

FIGURES

Figure 1 - Vicinity Map	3
Figure 2 - Photograph of Chartiers Creek	5
Figure 3 - Photograph of Chartiers Creek	5
Figure 4 - Floodway Schematic	13

TABLES

Table 1 - Summary of Discharges	8
Table 2 - Floodway Data	12
Table 3 - Flood Insurance Zone Data	14

EXHIBITS

Exhibit 1 - Flood Profiles Chartiers Creek	Panels 01P-02P
Exhibit 2 - Flood Boundary and Floodway Map	

PUBLISHED SEPARATELY:

Flood Insurance Rate Map

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Borough of Heidelberg, Allegheny County, Pennsylvania, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert Heidelberg to the regular program of flood insurance by the Federal Insurance Administration (FIA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these federally-supported studies are based. These criteria take precedence over the minimum federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 44 CFR, 60.3. In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgements

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were prepared by GAI Consultants, Incorporated, for the Federal Insurance Administration, under Contract No. H-4762. This work was completed in October 1979.

1.3 Coordination

On April 5, 1978, streams to be studied by detailed methods were identified at an initial Consultation and Coordination Officer's (CCO) meeting attended by representatives of the FIA, the Borough of Heidelberg, and GAI Consultants, Incorporated (study contractor). During the course of the study, the Pittsburgh District of the U. S. Army Corps of Engineers (COE), the U. S. Geological Survey (USGS),

the Southwestern Regional Planning Commission, and borough officials were contacted to obtain hydrologic and hydraulic information for this report. On May 13, 1980, a final CCO meeting was held with representatives of the FIA, the borough, and the study contractor to review the results of the study.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Borough of Heidelberg, Allegheny County, Pennsylvania. The area of study is shown on the Vicinity Map (Figure 1).

Chartiers Creek was studied by detailed methods. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction for the next five years, through October 1984.

Tributary A was studied by approximate methods. Approximate methods of analysis were used to study those areas having low development potential and minimal flood hazards as identified at the initiation of the study. The scope and methods of study were proposed to and agreed upon by the FIA.

2.2 Community Description

The Borough of Heidelberg is located in the southwestern portion of Allegheny County in southwestern Pennsylvania. It is bordered by the Township of Collier to the north, west, and south, the Township of Scott to the south and east, and the Borough of Carnegie to the north. Downtown Pittsburgh is approximately 5.5 miles to the northeast.

Heidelberg was incorporated in 1893 (Reference 1). The population decreased from 2,118 in 1960 to 2,034 in 1970; the 1975 estimate is 1,667 (Reference 2).

Heidelberg occupies 0.45 square mile in Allegheny County, of which 44 percent is residential development, 14 percent is non-residential development, and 42 percent is open space. There is no forest, crop, or pasture land within the community (Reference 3). The non-residential development is primarily industrial. Products manufactured and supplied by the industries in Heidelberg include fabricated sheet metal products (Reference 2).

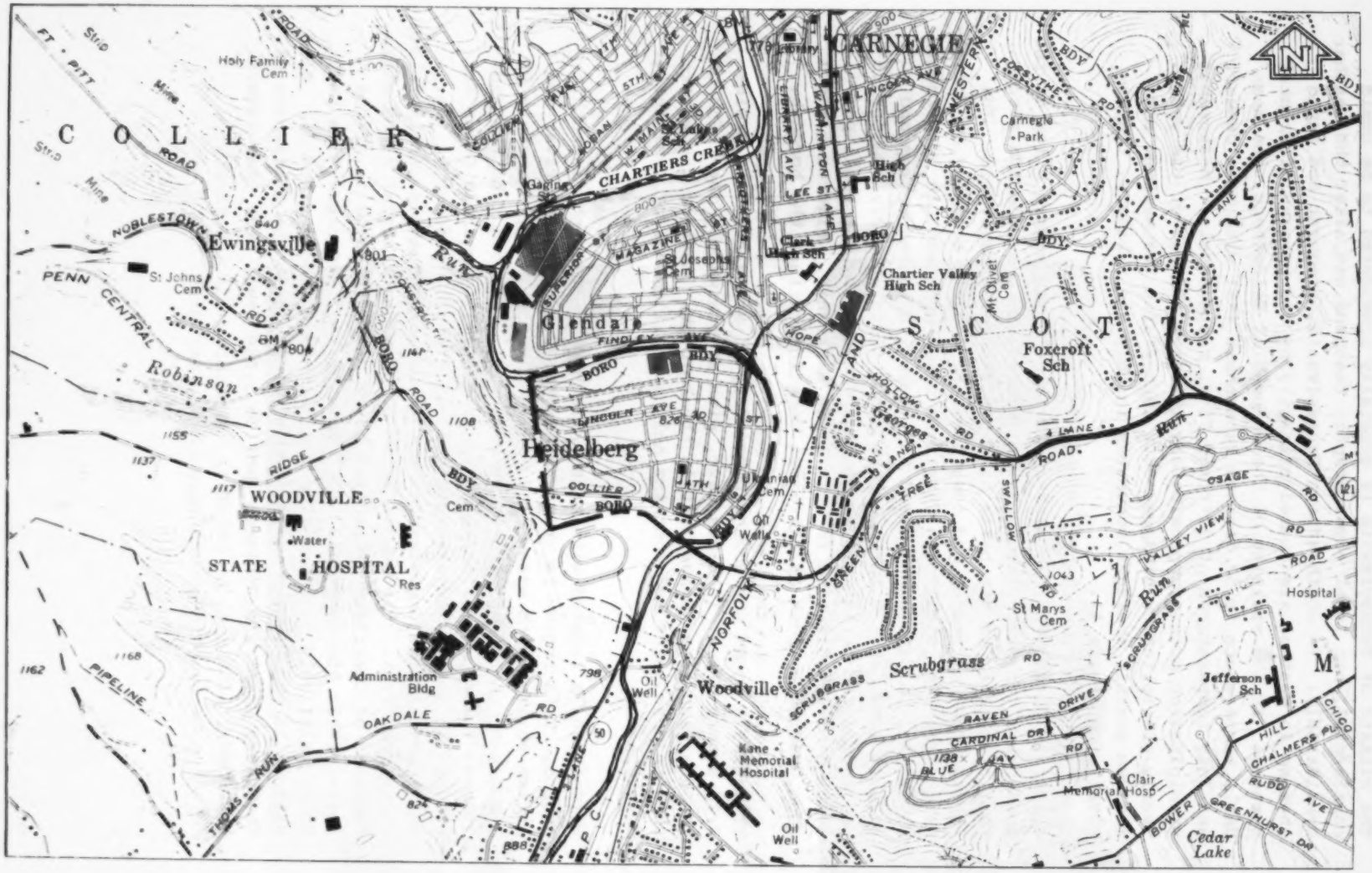


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

BOROUGH OF HEIDELBERG, PA
(ALLEGHENY CO.)

APPROXIMATE SCALE
2000 0 2000 4000 6000 FEET

VICINITY MAP

The climate of Pennsylvania is generally considered to be humid continental, but local physiographic features can alter the weather considerably. In southwestern Pennsylvania, frequent and rapid changes in weather are caused primarily by the passage of frontal systems. In the vicinity of the Borough of Heidelberg, the mean daily temperature is 53 degrees Fahrenheit (°F) with mean January and July temperatures of 32°F and 75°F, respectively. Measurable precipitation occurs approximately 150 days throughout the year. Yearly precipitation averages 36.0 inches with the maximum and minimum monthly averages occurring in July and February, respectively (Reference 4).

Chartiers Creek, which drains approximately 216 square miles at the downstream corporate limits of Heidelberg, is a meandering stream that originates in the hills of southwestern Pennsylvania. The stream flows northwest and comprises the eastern boundary of Heidelberg. The area within the Chartiers Creek watershed is 15 percent developed, 15 percent forested and wooded, 40 percent crop and pasture land, and 30 percent open space (Reference 3). Runoff is not considered to be influenced significantly by the small percentage of urbanization in this large watershed. Figures 2 and 3 show Chartiers Creek at different locations within the borough.

Tributary A forms the southern boundary of Heidelberg and drains 0.25 square mile. It flows east, with approximately one-fifth of the drainage area located within the borough. Most of the watershed is open space and contains only a small amount of residential development.

Heidelberg is located within the Allegheny Plateau physiographic region. This region is characterized by deep V-shaped river and stream valleys with steep hillsides and knolls. Approximately 50 percent of the soils within the borough are derived from the sandstones, shales, and limestone strata of the Monongahela Group and occupy the higher elevations. Approximately 25 percent of the soils are terrace deposits formed when glaciers caused ponding along Chartiers Creek. The remaining 25 percent are alluvial flood plain deposits of Chartiers Creek (Reference 5). The majority of the soils within the borough exhibit low infiltration capacities and, thus, relatively high runoff potentials (References 6 and 7). Elevations in the borough range from 780 feet, near the confluence of Chartiers Creek and Robinson Run, to 1,000 feet, near the western boundary.

Figure 2 - Chartiers Creek looking upstream at the Washington Avenue bridge.

Figure 3 - Channelization is shown on Chartiers Creek looking upstream from near Washington Avenue bridge.

2.3 Principal Flood Problems

Major floods occurred on Chartiers Creek in 1912, 1913, 1915, 1920, 1922, 1936, 1945, 1956, 1961, 1963, and 1966. The flood of record occurred in September 1912 and was estimated, by high-water mark comparisons by the COE, to have a flow of 21,000 cubic feet per second. Since 1916, discharges on Chartiers Creek have been recorded by the USGS gaging station (No. 85500) located in Carnegie. The largest discharges recorded at the gaging station were in June 1920, March 1945, and August 1956. The following tabulation shows the elevations at the USGS gage and the approximate recurrence intervals of six of the floods recorded at the gaging station. Total damage in dollars caused by the last four floods is also included (References 8, 9, 10, and 11).

Date	Total Damage (1969 dollars)	Flow (cfs)	Gage Elevation (feet)	Approximate Recurrence Interval (years)
September 1912		21,000		100
June 1920		12,800		20
March 1945		12,200	775.5	18
August 1956	5,450,000	13,500	778.4	26
April 1961	37,200	7,180	773.3	5
March 1963	3,360,000	10,600	776.2	14
February 1966	70,110	9,190	775.9	9

The damage caused by these floods can be related to the extensive flood plain development along Chartiers Creek. The wide, flat flood plain has primarily been used for industrial development. Within Heidelberg, several industrial buildings and a good portion of the residential development occupy the flood plain.

Flood problems and damage are relatively insignificant on Tributary A. This can be attributed to the small drainage area and the lack of development within the watershed and flood plain.

2.4 Flood Protection Measures

The Flood Control Act of 1965 authorized major channel improvement on Chartiers Creek in the vicinity of Carnegie, Heidelberg, and Bridgeville. The project, which began in 1968, extends from near the Scully Yard railroad bridge, which is approximately 6.3 miles downstream of the corporate limits of Heidelberg, to a point 11.2 miles upstream (Reference 12). Improvements to the area of Chartiers Creek contiguous to Heidelberg were completed in 1975.

Flood protection was provided by widening, deepening, realigning, and uniformily sloping the original channel, installing riprap and concrete stream banks, installing new bridges, and constructing a major cutoff channel (to be completed in 1981) within the Township of Collier. The project was designed to carry a flood discharge equivalent to the September 1912 flood. These improvements have drastically reduced flood hazards in the Borough of Heidelberg. Had the project been constructed prior to the flood of 1912, flood elevations for that event would have been approximately 8.5 feet lower at the USGS gaging station in Carnegie (Reference 11).

3.0 ENGINEERING METHODS

For the flooding source studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one-percent chance of annual occurrence) in any 50-year period is about 40 percent (four in ten) and, for any 90-year period, the risk increases to about 60 percent (six in ten). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for the flooding source studied in detail affecting the community.

Peak flows were estimated from curves relating discharge to drainage area. The curves were developed by Michael Baker, Jr., Inc., for the entire Chartiers Creek basin (Reference 13) and were reviewed and deemed suitable for the Chartiers Creek basin by the Pittsburgh District of the COE. The curves were based on log-Pearson Type III frequency analyses of data from the USGS gage in the Borough of Carnegie and data recorded by the COE at the Town of Canonsburg (Reference 14). These two sites are located downstream and upstream of Heidelberg on Chartiers Creek, respectively. Log-Pearson Type III frequency analyses of data from smaller gaged watersheds in the vicinity of Chartiers Creek were also used in developing the curves. A summary of drainage area-peak discharge relationships for Chartiers Creek is shown in Table 1, "Summary of Discharges."

The 100-year flood discharge for Tributary A was estimated using a flood-flow frequency equation developed by the COE (Reference 15).

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
CHARTIERS CREEK					
Downstream limit of detailed study	216	8,800	16,800	21,200	33,600

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the flooding source studied in detail were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along this flooding source.

Elevations of the selected floods were estimated using the COE HEC-2 water-surface profiles computer program (Reference 16). The program computes and plots the water-surface profiles for river channels at any cross section. The effects of various hydraulic structures such as bridges, culverts, weirs, embankments, and dams can be evaluated. The program is an application of Bernoulli's Theorem

for the total energy at each cross section, with Manning's "n" formula used to evaluate the head loss between cross sections. Input requirements for the program include stream cross sections at selected intervals, a starting water-surface elevation for each flood, estimates of roughness coefficients (Manning's "n") for each reach, dimensions of hydraulic structures, and the discharge for each flood.

Bridge data and channel cross sections were obtained from construction drawings for the Chartiers Creek Flood Control Project. The drawings were furnished by the Pittsburgh District of the COE. The overbank stations and elevations of the cross sections were determined by aerial photogrammetry (Reference 17).

Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals. Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway is computed (Section 4.2), selected cross-section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

Starting water-surface elevations for Chartiers Creek were taken from the Flood Insurance Study for the Borough of Carnegie (Reference 11). Due to slight deterioration of the channel improvement project for Chartiers Creek, the channel roughness coefficient (Manning's "n") was estimated to range between 0.030 and 0.031. The overbank roughness coefficients were estimated by field inspection and inspecting aerial photographs. The overbank roughness coefficients ranged from 0.040 to 0.075.

All elevations used in this study are referenced to the National Geodetic Vertical Datum of 1929 (NGVD), formerly referred to as Sea Level Datum of 1929. Locations of the elevation reference marks used in the study are shown on the maps.

The hydraulic analyses for this study are based on the effects of unobstructed flow. The flood elevations shown on the profiles are valid only if hydraulic structures remain unobstructed, and dams and other flood control structures operate properly and do not fail.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the FIA as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For the stream studied in detail, the boundaries of the 100- and 500-year floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:2,400 with a contour interval of 4 feet (Reference 17). In cases where the 100- and 500-year flood boundaries are close together, only the 100-year boundary has been shown.

The flood boundaries for Tributary A were estimated by determining the 100-year normal depth for representative valley cross sections taken from USGS topographic maps (Reference 18). The approximate study flood boundaries were field-checked for reasonableness.

The boundaries of the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map (Exhibit 2). Small areas within the flood boundaries may lie above the flood elevations and, therefore, may not be subject to flooding. Owing to limitations of the map scale and lack of detailed topographic data, such areas are not shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood can be carried without substantial increases in flood heights. Minimum standards of the FIA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. The floodway in this report is presented to local agencies as a minimum standard that can be adopted or that can be used as a basis for additional studies.

The floodway presented in this study was computed on the basis of equal conveyance reduction from each side of the flood plains. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 2). Portions of the floodway widths of Chartiers Creek extend beyond the corporate limits.

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway widths were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 4.

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the FIA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHFs), and flood insurance zone designations for the flooding source affecting the Borough of Heidelberg.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
Chartiers Creek								
A	525	156	2,626	8.1	780.3	780.3	781.1	0.8
B	2,305	139	2,348	9.0	781.9	781.9	782.6	0.7
C	3,455	158	2,542	8.3	783.3	783.3	783.9	0.6
D	4,965	131	2,089	10.1	784.8	784.8	785.3	0.5
E	6,405	132	2,298	9.2	786.7	786.7	787.1	0.4

[1] Feet above corporate limits
[2] This width extends beyond corporate limits

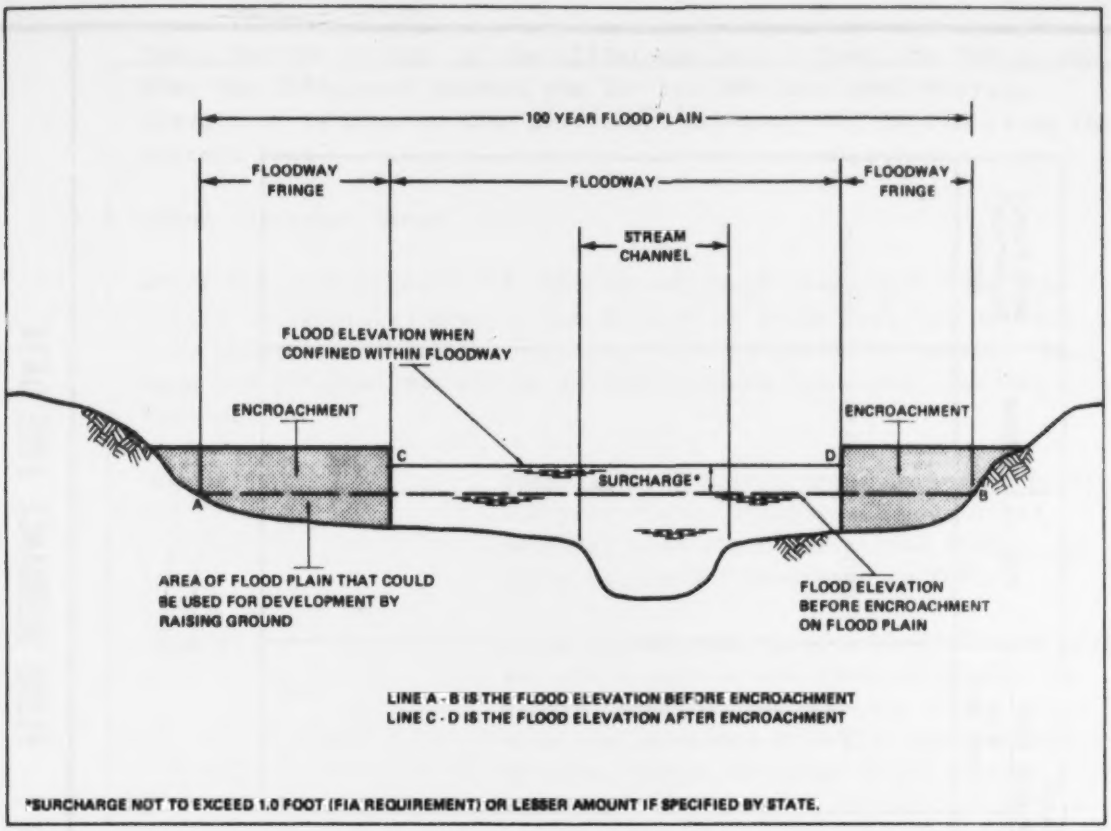
TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

BOROUGH OF HEIDELBERG, PA
(ALLEGHENY CO.)

FLOODWAY DATA

CHARTIERS CREEK


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FIA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FLOODWAY SCHEMATIC Figure 4

The locations of the reaches determined for the flooding source of the Borough of Heidelberg are shown on the Flood Profiles (Exhibit 1) and are summarized in the Flood Insurance Zone Data Table (Table 3).

5.2 Flood Hazard Factors

The FHF is the FIA device used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHFs are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest 0.5 foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4

FLOOD INSURANCE ZONE DATA

CHARTIERS CREEK

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND 10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)	FHF	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
Chartiers Creek Reach 1	01	-7.8	-2.6	+8.7	080	A16	Varies

[1]Flood Insurance Rate Map Panel
[2]Weighted average
[3]Rounded to the nearest foot - see map

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

BOROUGH OF HEIDELBERG, PA
(ALLEGHENY CO.)

TABLE 3

feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHFs, the entire incorporated area of the Borough of Heidelberg was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

Zone A16: Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones subdivided according to FHF.

Zone B: Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; also, areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.

Zone C: Areas of minimal flooding.

Table 3, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHFs, flood insurance zones, and base flood elevations for the flooding source studied in detail in the Borough of Heidelberg.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the Borough of Heidelberg is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This

map is developed in accordance with the latest flood insurance map preparation guidelines published by the FIA.

6.0 OTHER STUDIES

The Flood Insurance Study for the Borough of Carnegie has been completed (Reference 11). The results of this study are in exact agreement with the results of that study. Flood Insurance Studies for the Townships of Scott and Collier are currently being prepared (References 19 and 20). The results of those studies will be in exact agreement with the results of this study.

This study is authoritative for purposes of the Flood Insurance Program, and the data presented here either supersede or are compatible with previous determinations.

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic, and other pertinent data used in this study can be obtained by contacting the office of the Insurance and Mitigation Division of the Federal Emergency Management Agency, Regional Director, Region III Office, Curtis Building, Room 700, Sixth and Walnut Streets, Philadelphia, Pennsylvania 19106.

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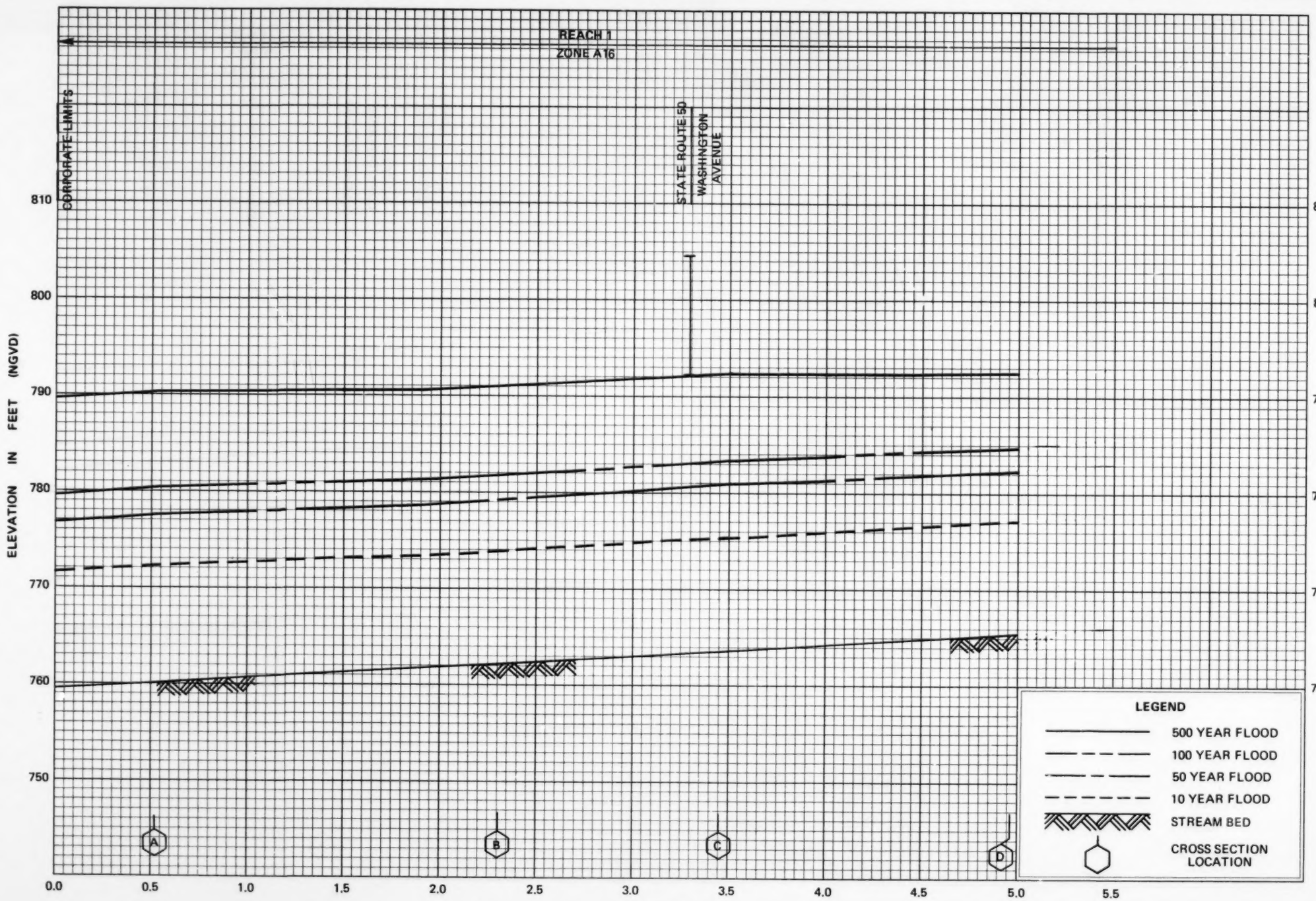

FLOOD PROFILES

CHARTIERS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

BOROUGH OF HEIDELBERG, PA
(ALLEGHENY CO.)

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FLOOD PROFILES

CHARTIERS CREEK

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BOROUGH OF HEIDELBERG, PA
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